CHAPTER 1

INTRODUCTION

1.1 Research Background

A fuel cell is an electrochemical device that converts the chemical energy of a reaction directly into electrical energy. Fuel cell also can be define as the chemical energy of a fuel and oxidant is convert directly into electrical energy.

The fuel cell is one of the electrochemical device that contain two electrodes and electrolyte that uses in chemical reaction to produce electricity. Many people thought that a fuel cell look like a battery. However, it didn't like a battery because a fuel cell never "goes dead" and never needs recharging. As long as a fuel cell has a constant supply of fuel and oxygen, it will continue to produce among or power. A fuel cell had been used since year 1839 till now.

Because of the role of coal as the major fuel at the beginning of the 20th century, the emphasis was put on coal-derived fuels first. Early 1960s, General Electric company produced the fuel cell-based electrical power system for NASA's

Gemini and Apollo space capsules. General Electric used the principles found in the 'Bacon Cell' as the basis of its design. Today, the Space shuttle's electricity is provided by fuel cells, and the same fuel cells provide drinking water for the crew. NASA decided that using nuclear reactors was too high a risk, and using batteries or solar power was too bulky to use in space vehicles. The fuel cell can uses in many sector such as transportation and industrial. It also used in space. It also was used in vehicle engine system such Toyota and Benz.

Generally, fuel cells also have their advantages and disadvantages too. Fuel cells have various advantages compared to conventional power sources, such as batteries and in engine. From all advantages that state in different book and journal,we can see that fuel cells eliminate pollution caused the product of combustion of fossil fuel is only water. Fuel cells also can eliminate greenhouse gases if the hydrogen used comes from the electrolysis of water. Since hydrogen gas can be produced anywhere where there is water and electricity, production of potential fuel can be distributed. The installation of smaller stationary fuel cells leads to a more stabilized and decentralized power grid. As we know, fuel cells have a higher efficiency than diesel or gas engines. Compared to internal combustion engines, most fuel cells can operate silently.

Proton exchange membrane fuel cell (PEMFC) is one of the fuel cell that uses in automotive and stationary power application. Its also is using for lower power CHP systems. Proton exchange membrane fuel cells (PEMFCs) are also known as polymer electrolyte membrane fuel cells. Sometimes, proton exchange membrane fuel cells (PEMFCs) are also known as membrane fuel cells.

PEMFC is used in automobile application. Some car manufacturers are working on their own fuel cell technology such as General Motors, Toyota, and Honda. Beside that, PEMFC also used on scooters and bicycles. PEMFC also is used as power backup. Proton Energy Systems demonstrated regenerative fuel cells combining its own PEM electrolyzer technology with Ballard's Nexa units. PEMFC also will used by NASA in the future as energy source on space. The electrolyte that used in PEMFC is polymer membrane. It was operated at temperature range 50-

100°C. PEMFC is types of the fuel cell that state in low temperature fuel cell section. Its used membranes as one of the fuel cell process.

In oder to get the most efficient system of PEMFC, the membrane develop need to have a good and stable membrane operating at desired temperature and pressure. The need of developing membrane that satisfies this condition with the minimum cost of production and maintenance are recommended.

1.2 Problem Statement

The increasing of the energy and the large demand of power generation can cause harmful to our environment. It can cause greenhouse and other pollutant to the environment. CO_2 will be produce during combustion process. CO_2 will be increase into our environment and cause emission. CO_2 emission from developing nations could account for more than half the world's CO_2 emissions. In the present of water and CO_2, it can cause solidification and corrosion.

In aspect transportation, the vehicle need electric that have high efficiency. Heat engine need to achieve a large temperature differential to achieve the same Carnot cycle efficiency. The combustion of engines, whether piston or turbine have good efficiency, but in present of fuel cell, it can be more efficient than that and can help to reduce the emission.

The batteries have their own limit. It need to recharge if it power is empty. Different with the fuel cell, it never goes dead and never need to recharge. As long as fuel cell has a constant supply of fuel and oxygen, it will continue to produce among of power.

Currently, common membrane for Proton Exchange Membrane Fuel Cell (PEMFC) is perflourosulfonic acid called NafionTM. Until now Nafion remains as standard for industry but it was very expensive to produce and require heat, high pressure and high level hydration in oder to perfom effectively. Thus the main